

decision signal representing the reception of an echo.

A step 160 following the step 150 derives the measured time interval from the output signal of the time measurement circuit 50. The step 160 calculates the distance to the detected object from
5 the subject vehicle on the basis of the measured time interval and the velocity of light. After the step 160, the current execution cycle of the program segment ends.

The step 120 in Fig. 5 provides a preliminary emission of the laser light. The step 150 in Fig. 5 provides a main emission of the
10 laser light which is executed after the preliminary emission thereof. A set of a preliminary emission of the laser light and a main emission thereof is executed for each of the directions (the angular directions) D1-DN of the transmission of the forward pulse laser beam which form the detection area. Thus, a set of a preliminary
15 emission of the laser light and a main emission thereof is repetitively executed a plurality of times during every cycle or period of the motor drive signal outputted from the microcomputer 90 to the motor drive circuit 18 (see Fig. 1), that is, during every period of the scanning of the detection area by the forward pulse
20 laser beam.

With reference to Fig. 6, regarding every set, the main emission is executed only in the case where an object is not detected in response to the preliminary emission. The main emission is not executed in the case where an object is detected in
25 response to the preliminary emission. The non-execution of the main emission reduces the number of times of the activation of the

laser diode 11 and lengthens the life thereof.

The step 125 in Fig. 5 corresponds to a second calculating means. The step 131 in Fig. 5 corresponds to an obstacle judging means.

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Fourth Embodiment

A fourth embodiment of this invention is similar to the third embodiment thereof except for design changes mentioned hereafter. Fig. 7 is a flowchart of a segment of a program for a microcomputer 90 (see Fig. 1) according to the fourth embodiment
10 of this invention. The program segment in Fig. 7 is a modification of the program segment in Fig. 5.

As shown in Fig. 7, a first step 110 of the program segment sets the power control signal into the state corresponding to lower than the normal power.

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A step 120 following the step 110 sets the pulse-width control signal to a state corresponding to a predetermined large pulse-width. The step 120 outputs the light-emission start requirement signal and the pulse-width control signal to the signal generation circuit 40 (see Fig. 1). Therefore, the pulse generation
20 circuit 40 outputs a pulse of the transmission signal to the laser-diode drive circuit 12 (see Fig. 1). The time point of the leading edge of the pulse is determined by the light-emission start requirement signal, while the width of the pulse is determined by the pulse-width control signal.

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The laser-diode drive circuit 12 activates the laser diode 11 (see Fig. 1) in response to the pulse of the transmission signal so

that the laser diode 11 emits a corresponding pulse of the laser light. The time point of the leading edge of the pulse of the laser light is determined by the light-emission start requirement signal, while the width of the pulse of the laser light is determined by the pulse-width control signal. Since the power control signal is in the state corresponding to lower than the normal power, the power of the pulse of the laser light is lower than the normal power. Since the pulse-width control signal is in the state corresponding to the predetermined large pulse-width (see the step 120), the width of the pulse of the laser light is equal to a large value. The pulse of the laser light is made into a pulse of the forward laser beam. Since the power of the pulse of the forward laser beam is relatively low, the measurable distance to an object is shorter than normal one. Accordingly, only in the presence of an object spaced from the subject vehicle by shorter than the normal measurable distance, the comparator 35 (see Fig. 1) outputs a high-level decision signal representing the reception of an echo.

A step 125 subsequent to the step 120 derives the measured time interval from the output signal of the time measurement circuit 50 (see Fig. 1). The step 125 calculates the distance to the detected object from the subject vehicle on the basis of the measured time interval and the velocity of light. In the absence of a received echo, the step 125 detects the absence of a detected object from the output signal of the time measurement circuit 50.

A step 131 following the step 125 determines whether or not the calculated distance to the detected object is shorter than a